SOME REMARKS ON TUMORS OF THE CHIASM, WITH A PROPOSAL HOW TO REACH THE SAME BY OPERATION.[1]

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I WISH to report briefly a case of tumor of the base of the brain which came to my observation recently, and will close my report by a few remarks on tumors of the chiasm in general, and a proposal of how to reach such tumors by operation.

The case in question is as follows:

G. L., aged sixteen years, was admitted to the German Hospital, December 9, 1903, and died December 12, 1903. The patient was first seen on March 10, 1903, by an ophthalmologist, Dr. Denig, to whom I am indebted for the following notes: The patient complains of poor vision for five months; since that time he has had from four to seven attacks daily of neuralgic headache. Got into the habit of shaking his head at times, and of holding it turned slightly to the right. When five years old he went through an alleged attack of meningitis.

Vision: Right, minus 0.5, minus cyl. 2.25, horiz. vision, ⅓.
Left, minus 0.5, minus cyl. 1, horiz. vision, ⅓.

Pupils normal; perimetrical examination shows bitemporal hemianopsia, and right optic nerve shows a varicose vein. Probable diagnosis: old meningitis, with hydrocephalus internus, or, more probably, tumor of the chiasm, possibly with varicosity. Optic normal. (I include drawings of the results of the perimetrical examination.) (Figs. 1 and 2.)

Dr. George W. Jacoby, to whom the case was sent, takes the matter for a residuum of the meningitis which the boy experienced at the age of five. To exclude acromegaly, thyroid tablets are given. On the 28th of July, the vision on the right side 1/6, left 1/4, a perceptible diminution. Slight hyperæmia in the vessels of the fundus. On December 8, the same vision as at the last examination. No other changes, except an increase of headaches. Had another consultation with Dr. Jacoby. Drs. Jacoby and Denig concur in the diagnosis of tumor of the chiasm, and decide on an operation to relieve pressure, with a view to a trial to extirpate the tumor.

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My examination of the patient on December 10 showed the following: Family history negative; the personal anamnesis being the same as above, except that projectile vomiting has to be mentioned, which occurred daily during the last six months. At present he has paroxysmal headaches every few minutes, which are, at the time of the intended examination, so strong that it has to be postponed; the patient being practically unconscious, or at best semi-unconscious. The hemianopsia is progressive, with marked primary atrophy of the hemianoptic fields, and slight hyperæmia. The knee-jerk and foot clonus are exaggerated, especially on the right side. No sensory disturbances. Slight optic atrophy, more marked in the right eye. Exophthalmus of right eye, pupils react equally to light; no oculomotor disturbances. Heart normal. Diagnosis: tumor of the hypophysis reaching to the anterior angle of the chiasm of the optic nerves, with pressure on the same. I may be permitted to state that bitemporal hemianopsia means blindness of both nasal halves of the retina.

After due consideration of the case and a consultation with the father of the patient about the chances of a removal of the tumor, this operation was decided upon.

The way to reach the chiasm in an operation is rather unexplored; and, while I have made a number of experiments to this purpose, some further operations on the cadaver were considered necessary, and the operation on the patient was therefore postponed a few days. During the night of December 11–12, that is two days after admission, the entire clinical aspect of the case changed suddenly. The temperature, which had been normal before, rose to 104° F., and the patient's condition became semicomatose. The right pupil was widely dilated, while the left presented the size of a pinhole. All four extremities were paralyzed to a certain extent. These symptoms indicated a perfora-

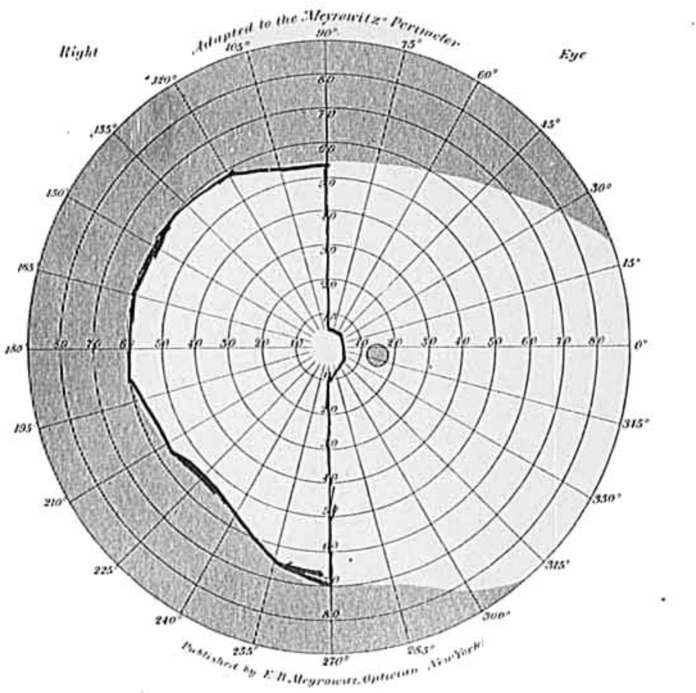

Fig. 1.—Perimetrical examination of right eye.

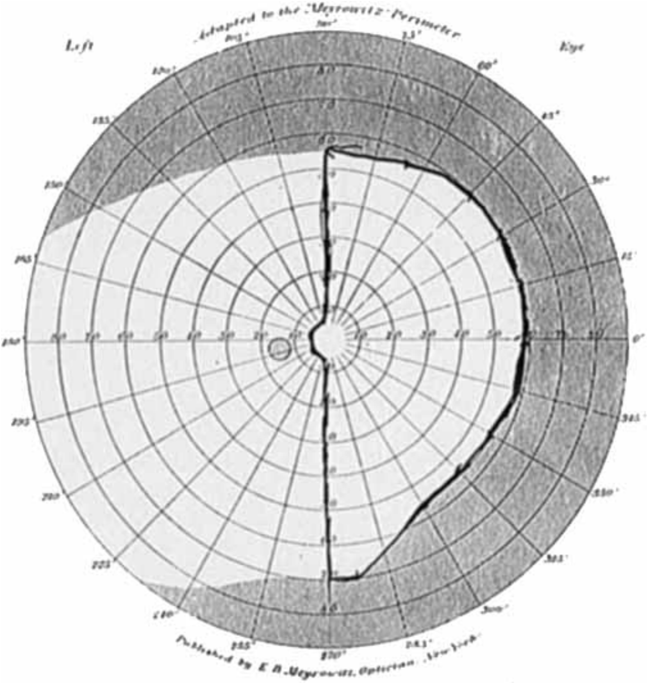

FIG. 2.—Perimetrical examination of left eye.

tion of the tumor, possibly cystic, into the lateral ventricle; eventually hæmorrhage into the same. For that reason an immediate operation was decided upon to relieve the pressure on the ventricle. The condition of the patient was so comatose that it was deemed possible to operate without narcosis; but shortly before the operation he revived so far that a slight chloroform anæsthesia became necessary.

Right side osteoplastic flap, after Wagner, was made with Sudek's fraise, with electric motor, to puncture the ventricle and to relieve pressure. The ventricle was struck without any difficulty, but only a few drops of serum appeared through the cannula. The patient's condition forbidding any further interference, none such was attempted. Replacement of the flap, dressing, patient put to bed. Temperature kept on rising, condition of the patient stayed the same till, eight hours after the operation, exitus took place.

Autopsy, by Dr. Schwyzer.—Cadaver of a moderately large boy, no œdemata, no atrophy. Skull shows small Wagner flap on the right side. Cranium not quite symmetrical, right occipital portion somewhat larger than left, bones remarkably thin; the dura tense, rather moist; vessels of the dura rather empty, sinus longitudinal, contains no blood; the lymphatic vessels appear to be imbibed with blood. Subdural space fairly moist, pia shows considerable arterial and venous injection. At the right side under the dura, corresponding to the parietal flap (which corresponds to the flap incision), is a plaque of coagulated blood of the thickness of several millimetres.

The corpus callosum, especially in its anterior portions, arches forward and appears quite resistant. After the brain has been removed, a round, dark tumor of the size of a plum is discovered in the region of the Chiasma opticorum. (Figs. 3 and 4.)

Both olfactory nerves apparently unchanged. The optical nerves appear to be spread and extend backward in a sagittal direction before converging.

To the right and left upon the cystic tumor protuberances like varices appear, which are filled with dark-colored blood, partly fluid, partly coagulated.

Puncture of the central portion of the tumor in the median line reveals a thick, bloody fluid containing many small, yellowish particles of tissue and fat crystals.

The tumor before incision was almost round, with a longitudinal diameter of about four to five centimetres; its anterior walls are quite thin.

The Sella turcica is remarkably deep, its posterior edge is corroded, quite sharp and projecting straight upward. The anterior edge also shows a distinct line of corrosion. The Sella turcica measures almost 3 centimetres in a sagittal direction, 3.5 centimetres across, and 1.5 centimetres in depth. The hypophysis cannot be found, so that the tumor must be looked upon as a tumor of the hypophysis. The portions of the tumor which lie in the lateral depressions of the Sella turcica, and the posterior parts of the tumor, contain grayish-red tissue, which, however, does not represent coagulated blood. The lateral sinuses contain fluid blood.

The left lateral ventricle contains a little clear fluid, the right a few drops of the same.

Addenda.—The tumor has a length of 4½ centimetres, a width of 2½ to 3 centimetres, and about an equal height. The olfactory nerves are not attacked, but the region of the Chiasma opticorum is involved. The veins at the base of the cranium (sinus cavernosus) are enormously dilated, and stretch in thick cords transversely above and below the tumor. The sinus intercavernosus anterior and posterior, especially, are transformed into wide canals. The tumor itself represents a cyst-like swelling filled with partly coagulated, partly half-fluid blood. In removing the brain, a small rip of the cyst occurs, from which soft, partly black, partly brown coagula and fluid blood are evacuated. In conjunction with these substances, soft gelatinous tissue of yellowish and brownish color are found, which represents the tissue of the cyst. The tumor is most firmly adherent to the Chiasma opticorum. An attempt to sever the tumor from the latter shows that the anterior branches of the chiasm are intact, while the posterior portions are wanting, *i.e.*, they seem to disappear in the cyst. No trace of the hypophysis can be found.

Microscopical examination of the cyst shows that the anterior portion of the tumor is practically one cyst, filled with blood; in the posterior portion it is solid tissue. The coagulated blood contains small particles of tissue, some of which possess the character of papillæ of cystadenoma. The wall of the cyst in its outer portions consists of fibrillary multinuclear connective tissue, while the inner layer is formed of small-celled tissue. The posterior

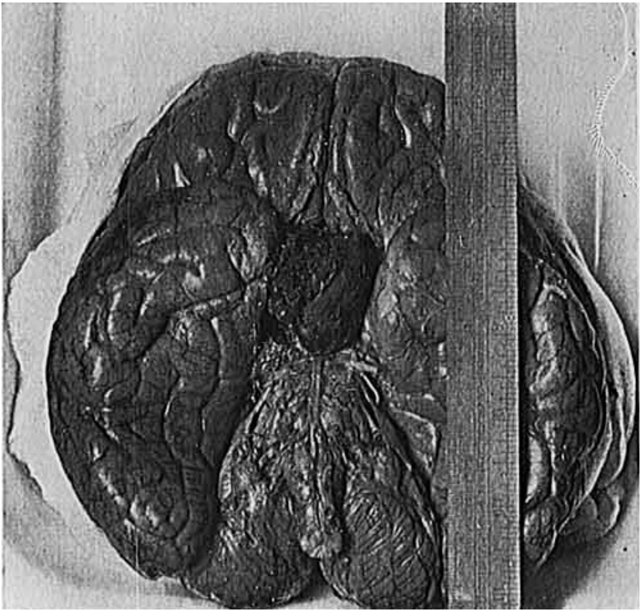

Fig. 3.—Base of brain showing tumor in situ.

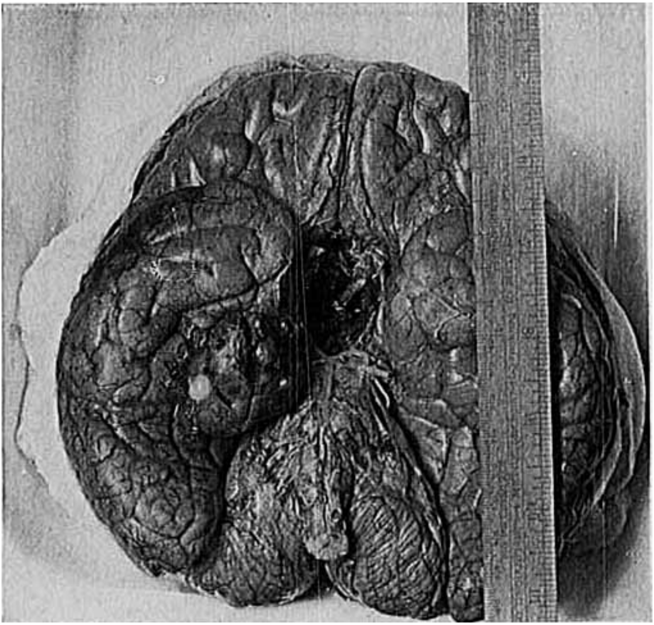

FIG. 4.—Tumor dislodged and held to one side by a pin, showing course and condition of optic nerves.

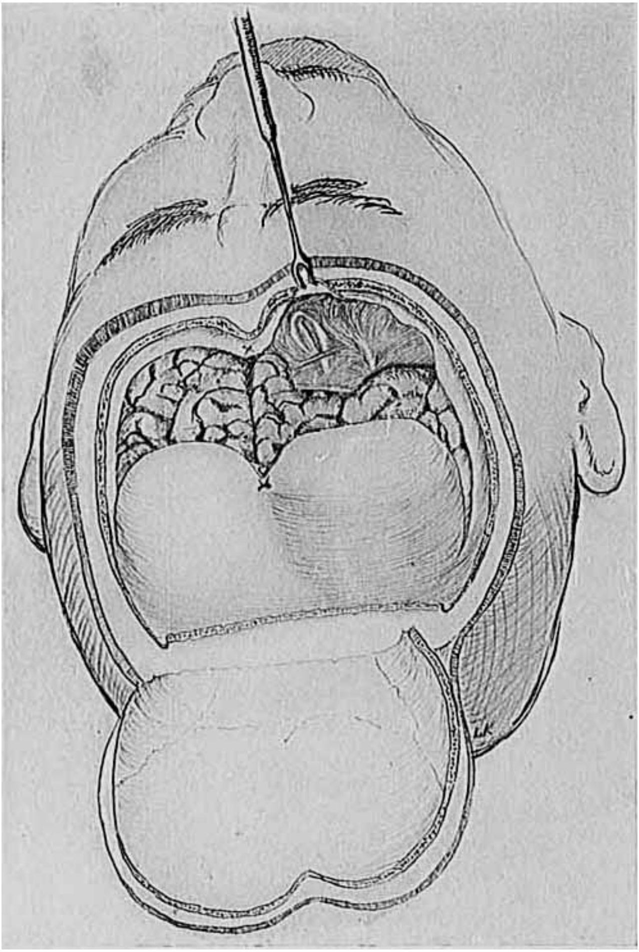

Fig. 5.—Proposed method of reaching tumors of the optic chiasm.

portions of the tumor show glandular tissue here and there, with cystic spaces filled with large colloid masses and with large epithelioid cells. Often the structure of a cystadenoma is clearly shown, but the adenoma-cells are relatively small. The stroma of the entire tumor consists partly of pigmentary cells; many parts of the posterior portion are more like connective tissue, with many blood-vessels and no glandular character, so that they might almost be looked upon as sarcomatous tissue.

Diagnosis.—Adenoma of the hypophysis with colloid degeneration resulting in compression of the basal venous system and partial destruction of both optic nerves. Finally, a hæmorrhage in the cysts of the tumor led to a rapid increase of volume with almost complete interruption of the optic nerves.

I may state right here that the rather unusual character of the tumor with its enormous vascularization would have forbidden absolutely any attempt to remove it, as a fatal hæmorrhage would have followed any such attempt most assuredly.

In looking through the literature, I found quite a large number of cases of tumors of the region of the chiasm. While I have not been able to follow all these cases, I have personally been able to trace forty-two, quite a large number of which are cases of acromegaly, the others being tumors of the pituitary body without any symptoms of that disease. It is therefore only natural to consider the possibility of reaching these tumors by operation, and I dare say that if most of these cases did not come under the observation of the nerve and eye specialists, as is natural, the idea of an operative interference would probably have been approached before; if such has been the case, I am not aware of it, at least I have not been able to find anything about it in the literature.

If the region of the chiasm can be reached at all for technical or anatomical reasons, the operation may be indicated either for purely symptomatic causes or for curative purposes. The presence of a tumor at the chiasm probably never makes itself manifest till pressure on the optic nerves ensues. Therefore an operation would in a certain way always have to be for symptomatical reasons; this all the more as the tumors of the hypophysis have not the tendency to sarcomatous degeneration common to other parts of the brain. This is another reason which makes these operations appear desirable, as the final prognosis is decidedly better and more encouraging than with other parts of the brain, these tumors proving to be of a non-malignant character. The question of acromegaly and its possible treatment or cure by operation on the hypophysis is a matter rather difficult to discuss as long as the opinions about the etiology of that disease are so divided. If hypertrophy of the hypophysis is only one of the symptoms of acromegaly, like the hypertrophy of other extremities, operative interference for total or partial removal would not be indicated until the tumor exerts pressure on the chiasm. If, on the other hand, the disease, as such, was produced by the original hypertrophy of the pituitary body, an early operative interference might be of some avail.

The reason why tumors of this locality have so seldom been operated upon lies entirely in the difficulty of reaching them. The attempt to get at the chiasm by a temporal flap, lift up the temporal lobe of the brain, and work one's way along the pars petrosa of the temporal bone is frustrated by the extremely dense adherence of the dura to the bone. Even if we should succeed in reaching the anterior foramen lacerum between the canalus caroticus and foramen ovale, we would find ourselves behind the Sella turcica, in fact, behind the processus clinoidus posterior. Besides, a very large side flap would have to be made in order to lift up the brain high enough not to work entirely in the dark.

Several years ago I was impressed with the desirability of reaching the chiasm, and therefore tried the following modus: A modified operation after Kroenlein's method for reaching the rear parts of the orbita was considered feasible by combining it with a large frontal flap. The idea was then to break this large frontal flap downward in such a way that, after its detachment from the zygomatic process, it could be turned downward forward, bringing with it the entire upper roof of the orbita. This operation having been done several times on the cadaver, it was attempted in a case where the diagnosis of tumor of the chiasm was made. The operation had to be discontinued, as it was impossible to break out the flap. The autopsy showed that an enormous sarcoma of the brain existed, with no symptoms except those produced by pressure on the chiasm, combined with a very extended osteosarcoma of the skull, which easily explained the impossibility of breaking out the flap. But I have convinced myself since then that any extra dural operation is without value in an attempt to reach the chiasm, as the same difficulties meet us here that we find in the operation with the side flap, namely, the dense attachment of the dura to the bone. Therefore intradural operations had to be decided upon for this purpose. Besides, there is another objection to this way of opening the skull, as many surgeons may be loth to break the roof of the orbita in the proposed fashion, as one cannot be reasonably sure how it is going to break, and even possible injury to some of the veins may result.

I therefore came to the conclusion that the only rational way of getting at the chiasm was in the following manner: A Wagner flap is formed on the frontal bones with true omega shape, the base of which lies about half an inch behind the sutura coronaria, the indentation of the omega comes to lie exactly in the median line, to avoid, if possible, the opening of the sinus frontalis. The dimensions of the bone flap thus formed are in the median line 5 inches, the lateral diameters being 5½ inches, the width 7 inches, and the base where it is broken off 3½ inches. The skin incision severs the temporal artery on both sides. The opening of the skull is made with a Sudek's fraise with electric motor beginning at the base of the flap, the fraise is then led on forward, following closely the line of the omega formed in such a manner that the distance of the horizontal branches from the orbital margin is three-quarters of an inch, then going upward to describe the indentation for the purpose of avoiding the sinus, thus reaching a height of one and one-half inches from the root of the nose. The other half of the flap is symmetrical.

After a number of discouraging experiments, I have been able to bring the time for cutting the bone down to eight minutes.

The failures in my former experimental efforts were due entirely to the fraises not being sharp enough and too softly tempered. The electric motor is of one-quarter horsepower with the usual 120 voltage of the street current. I attach a great deal of importance to the quick work of the fraise, because the danger of forming such a large flap is decidedly lessened if there is less loss of blood by quick work. Any injury to the dura can easily be avoided if the instruments are well made, that is, if the protective knob of the fraise is perfectly smooth. After this a Gigli director is inserted from the starting to the finishing point, and the flap sawed through, or at least partially. After breaking the flap, the incision in the dura is made, following the line of the bone closely in the distance of half an inch up to the median line, where the sinus is left intact. The other half of the incision is symmetrical to the first. We now tie the longitudinal sinus, which is only a small vein at this place. The ligation is best made by first applying two clamps, between which the falx is cut through, and then the ligatures applied. The dura need not be dissected back any further, thus avoiding undue oozing. Now begins the work of the lifting up and out of the frontal lobe of the brain, which is done with two brain spoons. The frontal lobe can thus be shoved back without any trouble or hæmorrhage, till the optic nerve comes into view. The only disadvantageous thing liable to happen is the tearing off of the olfactory bulb of one side. I have used this method now repeatedly on the cadaver, and cannot find any objection to it, as far as one can judge from operations on the cadaver. (Fig. 5.)

The principal danger in most brain operations is, of course, hæmorrhage, but during the steps described it is almost inconceivable that a hæmorrhage of any importance can occur. Thus far I have only described how to reach the anatomical point desired. What is then to be done depends on the character and size of the tumor to be found. The danger of hæmorrhage now to be encountered is especially from the intercavernous sinus. Cysts of the hypophysis, which are not at all infrequent, would of course lend themselves most easily to treatment by evacuation, while adenomata, if they are not too hard, will permit of a partial removal by the sharp spoon. Any hæmorrhage occurring now, I would try to stop by temporary tamponade, and finally by laying a thin piece of rubber tissue on the surface, and allowing the brain to drop back into place.

I am quite aware how awkward it must appear to recommend an operation which I have only been able to try on the cadaver. But these cases are, after all, not so frequent that one surgeon would see many of them. Therefore I bring this operation to the attention of surgeons.